

## Space Science Enterprise

### Mission

The primary Goal of the Space Science Enterprise is to chart the evolution of the universe from origins to destiny, and improve understanding of galaxies, stars, planets, and life (Figure 2). Within this Goal, Enterprise Objectives are to solve mysteries of the universe, explore the solar system, discover planets around other stars, and search for life beyond Earth. Other Enterprise Goals include developing innovative technologies to support Space Science programs and making them available for other applications that benefit the Nation. Enterprise missions and research also yield scientific information of value for future exploration programs. Knowledge and discoveries will be shared with the public to enhance science, mathematics, and technology education and increase the scientific and technological literacy of all Americans.

### Implementation Strategy

The Space Science Enterprise is continuing to develop new programs through the “faster, better, cheaper” approach. Program managers are encouraged to shorten the development time of technologies and missions, explore new conceptual approaches, streamline management, and incorporate innovative methods and technologies to enhance efficiency and effectiveness while maintaining safety. Continuing investment in long-term, high-payoff technologies, such as advanced miniaturization, intelligent systems, autonomous operations, and simulation-based design, are key to implementing the Space Science mission. Collaborative efforts with other Federal agencies, such as the National Science Foundation, Department of Defense and Department of Energy, as well as with international partners, play a key role in the implementation strategy of the Enterprise.

### Enterprise Resource Requirements

The President has requested the following budget for FY99 to FY05 to support the accomplishment of Space Science goals:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
NOA \$M	2,119	2,193	2,399	2,606	2,961	3,299	3,578
CS FTEs	1,846	1,751	1,740	1,728	1,745	1,750	1,762

### Performance Measures

The following measures summarize individual targets and indicators for Enterprise programs:

**Goal: Chart the evolution of the universe from origins to destiny, and understand its galaxies, stars, and life.**

**Objective: Solve Mysteries of the Universe**

- Successfully develop and launch no less than three of four planned missions within 10% of budget and schedule; an example is the Microwave Anisotropy Probe (MAP) (Target: 1S1).
- Obtain expected scientific data from 80% of operating missions; examples are the Chandra X-ray Observatory (CXO) and the Far Ultraviolet Spectroscopy Explorer (FUSE) (Target: 1S2).
- Perform innovative scientific research and technology development by meeting technology development objectives for major projects (for example, the Next Generation Space Telescope, NGST), by achieving a mission success rate of 80% for astronomy rocket and balloon flights, and by making satisfactory research progress in related Research and Analysis (R&A) and Data Analysis (DA) programs (Target: 1S3).

**Objective: Explore the Solar System**

(This objective includes missions to increase our understanding of the Sun and its effects on the Earth, as well as missions to explore the solar system.)

- Successfully develop and launch no less than one of two missions within 10% of budget and schedule; an example is the Mars 01 Orbiter (Target: 1S4).
- Obtain expected scientific data from 80% of operating missions; examples are the Cassini and Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) missions (Target: 1S5).
- Perform innovative scientific research and technology development by meeting technology development objectives for major projects (for example, the Solar-Terrestrial Relations Observatory, STEREO), by achieving a mission success rate of 80% for space physics rocket and balloon flights, and by making satisfactory research progress in related R&A and DA programs (Target: 1S6).

**Objective: Discover Planets Around Other Stars**

- Perform innovative scientific research and technology development by meeting interferometry technology development objectives (for example, for the Space Interferometry Mission, SIM) and by making satisfactory research progress in related R&A programs (Target: 1S7).

**Objective: Search for Life Beyond Earth**

- Perform innovative scientific research and technology development by meeting technology development objectives for the Europa Orbiter and by making satisfactory research progress in the related R&A program, including the Astrobiology program (Target: 1S8).

**Goal: Contribute measurably to achieving the science, math, and technology education goals of our nation.**

**Objective: Make education and enhanced public understanding of science an integral part of our missions and research**

- Continue and expand the integration of education and enhanced public understanding of science with Enterprise research and flight mission programs, including planning or implementing funded education and outreach activities in at least 34 states (Target: 1S9).

**Goal: Support human exploration through robotic missions.**

**Objective: Investigate the composition, evolution, and resources of Mars, the Moon, and small bodies**

- Investigate the composition, evolution, and resources of Mars, the Moon, and small bodies by successfully launching the Mars 01 Orbiter, by obtaining data from operational spacecraft (for example, the Mars Global Surveyor), and by making satisfactory progress in related R&A and DA programs (Target: 1S10).

**Objective: Develop the knowledge to improve the reliability of space weather forecasting**

- Develop the knowledge to improve the reliability of space weather forecasting by obtaining scientific data from three of five missions (for example, the Transition Region and Coronal Explorer, TRACE) and by making satisfactory progress in related areas in R&A and DA programs (Target: 1S11).

**Goal: Develop new technologies needed to carry out innovative and less costly mission and research concepts**

**Objective: Develop new technologies needed to carry out innovative and less costly mission and research concepts**

- Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the space science core technology programs (information systems, high performance computing, and Explorer program technology) and by making progress as planned in the Flight Validation program (Target: 1S12).

**NEW INITIATIVE**

**New Initiative: Living With a Star**

- Further understanding of basic natural processes and the effects of solar variability on humans and technology by achieving performance objectives for development of a strategic plan, completion of a mission definition study, and the initiation of targeted research and data analysis.

**Internal Assessment**

The Space Science program consists of numerous diverse components, and each component's performance must be assessed in an appropriate way. For some program elements, such as mission development, achievement of major milestones is easily identified through routine project management reviews. For missions in an operational phase, success can be gauged in terms of operating

efficiency or major data sets returned. For technology programs, progress can be predicted and measured in terms of technical capabilities achieved or successful laboratory or flight tests. In each of these cases, performance assessment data can be retrieved from normal project management reporting during the course of the fiscal year.

## **External Assessment**

For the basic research programs, evaluation must consider important contextual factors such as: the relative value of the research objectives; progress toward those objectives; productivity by prevailing research community standards; and impact on related research funded or performed by other agencies. Measures such as number of grants or scientists supported, publication counts, or research citations are not able to capture these important aspects of the evaluation requirement. The best way to assess research programs has been demonstrated to be an external peer review or visiting committee approach. The Enterprise will employ this mechanism to qualitatively assess the progress of its programs in basic research and data analysis against Enterprise strategic plan science goals and objectives. The reviews will determine whether these investigation programs are fully effective, are not as strong as desired but have returned results of significant value, or are not scientifically or technologically competitive. The review process will also identify those programs that have produced important unexpected results or have contributed to an unanticipated degree to other research.

### Space Science Enterprise FY 01 Performance Plan

Strategic Plan Goal	Strategic Plan Objective	#	FY01 Target	FY01 Indicator
Chart the evolution of the universe, from origins to destiny, and understand its galaxies, stars, and life	Solve Mysteries of the Universe	1S1	Successfully develop and launch no less than three of four planned missions within 10% of budget and schedule.	Performance indicators have been identified for four missions scheduled to launch in FY01; an example is the Microwave Anisotropy Probe (MAP). Indicators have also been established for other missions in development.
		1S2	Obtain expected scientific data from 80% of operating missions.	Performance indicators have been identified for six operating missions [examples are the Chandra X-ray Observatory (CXO) and the Far Ultraviolet Spectroscopy Explorer (FUSE)]. An indicator has also been established for another mission scheduled to launch in FY01; this indicator is to be utilized upon successful launch.
		1S3	Perform innovative scientific research and technology development by meeting technology development objectives for major projects, by achieving mission success in astronomy rocket and balloon flights, and by making satisfactory research progress in related Research and Analysis (R&A) and Data Analysis (DA) programs.	Performance indicators have been drawn from technology development objectives for three missions; an example is the Next Generation Space Telescope (NGST). Indicators have also been established for achievement of mission success for astronomy rocket and balloon flights and research progress in the R&A and DA programs.
	Explore the Solar System	1S4	Successfully develop and launch no less than one of two missions within 10% of budget and schedule.	Performance indicators have been identified for two missions scheduled to launch in FY01; an example is the Mars 01 Orbiter. Indicators have also been established for other projects in development.
		1S5	Obtain expected scientific data from 80% of operating missions.	Performance indicators have been identified for nine operating missions [examples are the Cassini and Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) missions]. Indicators have also been established for other missions scheduled to launch in FY01; these indicators are to be utilized upon successful launch.
		1S6	Perform innovative scientific research and technology development by meeting technology development objectives for major projects, by achieving mission success in space physics rocket and balloon flights, and by making satisfactory research progress in related R&A and DA programs.	Performance indicators have been drawn from technology development objectives for three missions, as well as for future mission sets and for specific multi-mission technology development efforts. An example of the individual missions is the Solar-Terrestrial Relations Observatory (STEREO). Indicators have also been established for achievement of mission success for space physics rocket and balloon flights and research progress in the R&A and DA programs.
	Discover Planets Around Other Stars	1S7	Perform innovative scientific research and technology development by meeting interferometry technology development objectives and by making satisfactory research progress in related R&A programs.	Performance indicators have been drawn from technology development objectives for three missions; an example is the Space Interferometry Mission (SIM). Indicators have also been established for the Keck Interferometer project and for achievement of research progress in the R&A program.

### Space Science Enterprise FY 01 Performance Plan

Strategic Plan Goal	Strategic Plan Objective	#	FY01 Target	FY01 Indicator
	Search for Life Beyond Earth	1S8	Perform innovative scientific research and technology development by meeting technology development objectives and by making satisfactory research progress in the related R&A program, including the Astrobiology program.	Performance indicators have been drawn from the technology development objectives for the Europa Orbiter. Indicators have also been established for achievement of research progress in the R&A program, including especially the Astrobiology program.
Contribute measurably to achieving the science, math, and technology education goals of our nation.	Make education and enhanced public understanding of science an integral part of our missions and research	1S9	Continue and expand the integration of education and enhanced public understanding of science with Enterprise research and flight mission programs.	Performance indicators have been identified for education and public outreach efforts. These indicators include the planning or implementation of funded education or outreach activities in at least 34 states.
Support human exploration through robotic missions	Investigate the composition, evolution, and resources of Mars, the Moon, and small bodies	1S10	Investigate the composition, evolution, and resources of Mars, the Moon, and small bodies by successfully launching a Mars mission, by obtaining data from operational spacecraft, and by making satisfactory progress in related R&A and DA programs.	Performance indicators have been identified for the Mars '01 Orbiter, scheduled to launch in FY01, and for a Discovery mission scheduled to be in development. Other indicators have also been identified for an operating mission, as well as for achievement of research progress in related R&A and DA programs.
	Develop the knowledge to improve the reliability of space weather forecasting	1S11	Develop the knowledge to improve the reliability of space weather forecasting by obtaining scientific data from three of five missions and by making satisfactory progress in related areas in R&A and DA programs.	Performance indicators have been identified for four operating missions; an example is the Transition Region and Coronal Explorer (TRACE). Indicators have also been established for another mission scheduled to launch in FY01 (to be utilized upon successful launch), as well as for achievement of research progress in the R&A and DA programs.
Develop new technologies needed to carry out innovative and less costly mission and research concepts	Develop new technologies needed to carry out innovative and less costly mission and research concepts	1S12	Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the space science core technology programs and by making progress as planned in the Flight Validation program.	Performance indicators have been identified for the space science core technology programs (information systems, high performance computing, and Explorer program technology), as well as for the Flight Validation program.
<i>New Initiative</i>	Living With a Star		Further understanding of basic natural processes and the effects of solar variability on humans and technology.	Performance indicators have been established for the development of the Living With a Star Strategic Plan, completion of a mission definition study, and the initiation of targeted research and data analysis.

<b>SSE FY01</b>	<b>Budget Category</b>	<b>SIRTF</b>	<b>HST Development</b>	<b>GP-B</b>	<b>SOFIA</b>	<b>Payloads</b>	<b>Explorers</b>	<b>Discovery</b>	<b>Mars Surveyor</b>	<b>Operating Missions</b>	<b>SR&amp;T</b>
<b>Performance Target</b>											
<i>Solve Mysteries of the Universe:</i> Successfully develop and launch no less than three of four planned missions within 10% of budget and schedule. (1S1)		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>				
<i>Solve Mysteries of the Universe:</i> Obtain expected scientific data from 80% of operating missions. (1S2)										<b>X</b>	
<i>Solve Mysteries of the Universe:</i> Perform innovative scientific research and technology development by meeting technology development objectives for major projects, by achieving mission success in astronomy rocket and balloon flights, and by making satisfactory research progress in related Research and Analysis (R&A) and Data Analysis (DA) programs. (1S3)											<b>X</b>
<i>Explore the Solar System:</i> Successfully develop and launch no less than one of two missions within 10% of budget and schedule. (1S4)						<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>		
<i>Explore the Solar System:</i> Obtain expected scientific data from 80% of operating missions. (1S5)										<b>X</b>	
<i>Explore the Solar System:</i> Perform innovative scientific research and technology development by meeting technology development objectives for major projects, by achieving mission success in space physics rocket and balloon flights, and by making satisfactory research progress in related R&A and DA programs. (1S6)											<b>X</b>
<i>Discover Planets Around Other Stars:</i> Perform innovative scientific research and technology development by meeting interferometry technology development objectives and by making satisfactory research progress in related R&A programs. (1S7)											<b>X</b>
<i>Search for Life Beyond Earth:</i> Perform innovative scientific research and technology development by meeting technology development objectives and by making satisfactory research progress in the related R&A program, including the Astrobiology program. (1S8)											<b>X</b>
<i>Make Education and Enhanced Public Understanding of Science an Integral Part of our Missions and Research:</i> Continue and expand the integration of education and enhanced public understanding of science with Enterprise research and flight mission programs. (1S9)		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<i>Investigate the Composition, Evolution, and Resources of Mars, the Moon, and Small Bodies:</i> Investigate the composition, evolution, and resources of Mars, the Moon, and small bodies by successfully launching a Mars mission, by obtaining data from operational spacecraft, and by making satisfactory progress in related R&A and DA programs. (1S10)								<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<i>Develop the Knowledge to Improve the Reliability of Space Weather Forecasting:</i> Develop the knowledge to improve the reliability of space weather forecasting by obtaining scientific data from three of five missions and by making satisfactory progress in related areas in R&A and DA programs. (1S11)										<b>X</b>	<b>X</b>
<i>Develop New Technologies Needed to Carry Out Innovative and Less Costly Mission and Research Concepts:</i> Plan, develop, and validate new technologies needed to enable future research and flight missions by achieving performance objectives in the space science core technology programs and by making progress as planned in the Flight Validation program. (1S12)											<b>X</b>
<i>Living With a Star (New Initiative) :</i> Complete Living With a Star Strategic Plan, including mission architecture, for the OSS Strategic Plan, complete a mission definition study, and initiate targeted research and data analysis.											<b>X</b>